1857MNRAS..17..225S

# *Observations on the Stars in the Nebula of Orion.*
## By Mr. Otto Struve.

(*Communicated by the Astronomer Royal.*)

"Being interested with the publication of M. Liapounov's paper on the nebula of *Orion* (*Monthly Notices*, March, 1856), I was induced last autumn to compare with the heavens the different catalogues of the stars situated in that nebula (Sir J. Herschel's, Lamont's, Bond's, and Liapounov's Catalogues), in order to ascertain the origin of certain discrepancies offered by them. The results of this investigation will be communicated to the astronomical world in a memoir that I am now preparing for publication, as an addition to that of M. Liapounov. But some results to which I was led will, I hope, appear to deserve the particular attention and future inquiry of astronomers established at stations more favourably situated for the observation of that object. For this reason I avail myself of this early opportunity to notify these observations to the Astronomical Society.

"Sir J. Herschel's Catalogue (no doubt the most complete, and at the same time the most systematically worked, that we possess) contains, in the *Regio Huygheniana*, besides the well-known 6 stars of the trapezium, 5 other small stars numbered by him 51, 57, 75, 78, and 88. When I first directed my attention to these stars, on the beautiful night of 1856, Oct. 30, I could well see all of them, excepting 78, that really appeared to be out of the reach of our refractor. The other four stars were estimated by me to be in the following order of brightness :—

| | | |
|---|---|---|
| 88 | magn. | 12 |
| 51 | ,, | 12, 13 |
| 75 | ,, | 12, 13 |
| 57 | ,, | 13 |

"It then immediately struck me that there was a sixth star *s*, nearer to the trapezium than any of the other stars, that appeared to have been overlooked by Herschel, if it has not been omitted by him for other reasons. On that night I estimated it brighter than 51, but not quite so bright as 88. By micrometrical measures I found its position with regard to $\theta$ *Orionis* $\Delta\alpha = -7''\cdot 3$, $\Delta\delta = -27''\cdot 6$.* On further inquiry it appeared that this star was not to be found in any of the other catalogues, excepting, perhaps, in that of Dr. Lamont, where a star (No. 28) is indicated approximately in the same direction from $\theta$, but at somewhat too great a distance.

---

* It may be desirable to remark that this star *s* is different from the new star of M. Porro, mentioned elsewhere in the present number. The differences from $\theta$ *Orionis* of M. Porro's star are roughly $\Delta\alpha = -4''$, $\Delta\delta = -5''$.—[EDITOR.]

1857MNRAS..17..225S

"Nine days later, on the 8th of November, *s* was hardly visible, while the other 4 stars remained nearly in the same order of brightness: however, it was still visible, and so it was Dec. 2; but at this date its brightness could by no means be estimated higher than 13·5, the extreme limit that I assign to stars visible with our refractor. Hence a variability of light was proved for this star.

"Afterwards, 1857, Jan. 20 and Feb. 21, no trace was to be seen of this star; but on March 1 it reappeared, and was estimated nearly as bright as 57. Bad weather prevented my continuing observations on the next following days until March 18. At this date *s* appeared in brightness between 88 and 51, but considerably nearer to 88; two days later, March 20, it was even brighter than 88. Since then it began to decrease. March 23, I found it nearer to 51 than to 57; March 24, it was certainly less bright than 57. Clouds prevented me from observing on the next following evenings; and when again the sky cleared up, the strong twilight had put an end to these observations.

"Starting from the magnitudes assigned above to the four comparison stars, we have therefore the following reduced magnitudes of *s*:—

| | | | |
|---|---|---|---|
| 1856, Oct. 30 | *s* = 12·3 | 1857, March 1 | *s* = 13·2 |
| Nov. 8 | 13·5 | 18 | 12·1 |
| Dec. 2 | 13·5 | 20 | 11·9 |
| 1857, Jan. 20 | not visible. | 23 | 12·7 |
| Feb. 21 | | 24 | 13·2 |

"These numbers, being deduced from comparison with stars of nearly the same brightness, might be regarded as exact within the limits of the exactitude with which the relative brightness of the comparison stars has been estimated by me. But here arises a new difficulty; for there are strong evidences that those comparison stars are equally subject to changes of light.

"The first of these stars, that exhibited strong indications of a variable light, was 75; but it was not until the last day's observations that I could satisfy myself entirely on this point. On the evening of March 1 it was so feeble that it could only be recognised by glimpses, and was not to be seen steadily; March 18, it offered almost the same appearance, so that I noted that it was certainly considerably inferior to 57. On the contrary, two days later, March 20, it was brighter than 57, but less bright than 51. From March 20 to 23 it appears to have yet a little increased in brightness; for on the last day I noted that it was now nearer to 51 than to 57. On the following night, March 24, it was again less bright than 57. From these observations, I think, there cannot remain a doubt about the variability of light in this star, unless the two chief comparison stars 51 and 57 were not themselves subject to changes of light; but even in that case the great difficulty I had to see 75 in the nights of March 1 and 18, while

1857MNRAS..17..225S

the other stars remained easily visible, would be a sufficient proof of its variability. From these observations the greatest changes of light of star 75 would, however, hardly exceed one magnitude; for it never was so feeble as to disappear entirely in our refractor (or less than 13·5), and never has been seen brighter than 12·5.

"Either 51 or 88 is equally subject to change of light. During the whole season 88 had taken the lead in the order of brightness of the indicated 5 stars of Herschel's Catalogue; but in the last night, March 24, there was no doubt 51 was far the brightest of them. I am not quite sure to which of those two stars to attribute the aforesaid change; but from the most noticed change of the relation of 51 to 57, I am inclined to think that 88 is the variable star.

"Of Herschel's star 78 I could not see the least trace, neither in the beautiful night of Oct. 30, nor in any of the subsequent nights, until March 20. This last date I thought I could see it by glimpses; but was not quite sure on this point. On the evening of March 24 it was distinctly visible, so that I was enabled to determine its position by estimation. Hence it appears that in the last period of my observations this star was on the increase.

"We have, therefore, amongst the 6 observed stars in the *Regio Huygheniana*, on a space of 3 to 4 square minutes, at least 4 variable stars; but I think the number of variable stars in the same region will yet be considerably increased by further observations. The sixth star of the trapezium, for instance, bears strong indications of variability. On former occasions I agreed perfectly with Mr. Lassell's remark, that this star was fully of equal brightness with the fifth star; but this year it appeared to me constantly inferior. Perhaps this variability will explain the circumstance, that this sixth star, even after its discovery by Herschel, could never be seen by my father in the Dorpat refractor, while the fifth star was regularly observed. Probably, also, two or three stars seen and measured by Mr. Lamont in 1837, will be found of variable light; for I do not think that stars, distinctly seen by the Munich refractor, should be entirely out of the reach of visibility at Pulkova, if they have not undergone considerable changes of brightness. Finally, perhaps some of the stars indicated, but rather suspected than observed, by De Vico, Bond, and others, in the immediate vicinity of the trapezium, might equally be found of variable light.*

"The existence of so many variable stars on such a small space in the central part of the most curious nebula in the heavens, must of course induce us to suppose these phenomena intimately connected with the mysterious nature of that body. But perhaps our knowledge of variable stars generally, and of minute stars especially, may not be considered at present sufficiently extended to admit conclusions of almost mathematical strength. Therefore,

---

* A letter from the Rev. W. R. Dawes on the detection of duplicity of a star in this nebula, published in the *Monthly Notices*, vol. viii. page 31, will now be read with increased interest and signification.—[Editor.]

1857MNRAS..17..225S

we must proceed by steps. One of the first questions that presents itself must be, Is the space of frequent variable stars limited by the Huyghenian region, or does it extend over the whole nebula? To answer this question peremptorily, we do not as yet possess sufficient data. The relative magnitudes indicated in Mr. Lassell's excellent catalogue, compared with those observed by Liapounov in the years immediately preceding the period of Lassell's observations, offer throughout an almost perfect agreement; so that we must conclude that in the short interval of their respective observations, no material change has happened in the *mean* brightness of any of the stars that are common to both observers. The agreement is somewhat less complete if we compare Sir J. Herschel's Catalogue with those of Lassell and Liapounov; but the differences in the indicated magnitudes, if reduced to the same scale, are not so great as to exceed the limits of admissible errors of estimation. In one instance, however, I am inclined to suppose a considerable variability of light. The star, No. 20, of Lassell's Catalogue, seen likewise by M. Liapounov, is the only star observed by those two astronomers, that does not occur in Herschel's list ($\Delta\alpha = +320''\cdot1$; $\Delta\delta = -184''\cdot0$). It is hardly admissible to suppose that, with the extraordinary care expended by Sir J. Herschel in the preparation of his catalogue, a star should have been overlooked by him that was bright enough to be distinctly seen in the Kazan refractor; the more so, as this star is situated in a very remarkable part of the nebula, in the *Regio Subnebulosa*, near the vertex of the angle formed by the sudden turn to the south of the *Proboscis Major*. The supposed variability of light in this star is supported by the fact that during the last winter this star belonged to the most difficult objects discernible by the Pulkova refractor, and certainly was inferior in light to many other stars that had been out of the reach of the Kazan refractor.

"On the contrary, the comparison of Bond's Catalogue would have led to many extraordinary conclusions; but I do not think those conclusions of any weight; for it appears that the said catalogue is crowded with errors, and worked without any system. Apparently, the author has expended more care on the graphical representation of the nebula than on the construction of the catalogue.

"Admitting that the observed rapid changes of light of those minute stars are connected with the nature of the nebula, it might be presumed we should equally be able to observe changes in the appearances of the nebula, and the distribution of the nebulous matter. But observations of this kind are subject to so many illusions that we cannot be cautious enough with regard to the conclusions to be derived from them. I do not think the common way followed by astronomers in the researches of this kind, viz. to compare with one another graphical representations made at different epochs by different observers, will ever lead us to results that might be regarded as above all doubt. The optical

1857MNRAS..17..225S

power of the telescope, the transparency of the atmosphere at different stations, the peculiarities of the eye of the observer, the degree of skill and experience in graphical representations of this kind, together with the influence of the imagination of the observer, form obstacles that it will ever remain difficult to remove if we proceed in this way. Perhaps, by continuing the same system during centuries, we might detect, if they exist, changes of a progressive nature; but we should never be able to ascertain changes that happen in short intervals. Now the observed rapid changes of light in the stars, must of course lead us to expect similar rapid, perhaps periodical, changes or fluctuations in the appearance of the nebulous matter. It is, therefore, to similar rapid changes that we have particularly to direct our attention; and we shall be much more able to ascertain their existence by comparative observations on the brightness and forms of some prominent portions of the nebula, than by general representations of it. We must as much as possible concentrate the observations on singular parts, and not extend them over the whole body at once. It is in this way that I have tried to proceed during the last winter, and I consider myself justified in saying that on different points I have been strongly impressed with considerable changes that have happened during the comparatively short period of my observations. Nevertheless, being fully aware to how many illusions similar observations are subject, I do not venture to regard these observations as positive facts, until they shall have found further corroboration, especially by observers placed in more favourable climates and provided with sufficient optical means for that purpose. With this view I beg leave to recommend to their attention the following parts of the nebula:

" 1. The bay, that extends from the *Sinus Gentilii*, in the direction to the trapezium. This bay has been delineated for the first time by Dr. Lamont, and has never been seen by Sir J. Herschel (*Cape Observations*, p. 32 (69)). Last autumn this bay appeared to me quite as dark as the *Sinus Gentilii;* but in the month of March it was filled with nebulosity, very little inferior in brightness to the surrounding portions of the *Regio Huygheniana.*

" 2. The nebulous bridge, that apparently crosses the *Sinus Magnus*, with a point of concentrated light in the middle. Herschel has represented this bridge; but perhaps not strongly enough, and certainly not far enough extended, and without the mentioned concentrated light. Lamont has only very feeble traces of it; Bond has not seen it at all; finally, Liapounov has given it in the shape of a promontory, with a strong concentration of light on its extremity. I have seen it during this winter, sometimes more resembling to Herschel's delineation; on other occasions, with the strong concentrated light, like Liapounov; but always extending considerably farther to, and nearly, if not entirely, approaching, the southern boundary of the *Sinus Magnus.*

" 3. The nebulosity near and round the star 75 of Herschel's